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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF ENTOMOLOGY
WASHINGTON, D. C.

Official Business

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$300

MISCELLANEOUS CIRCULAR NO. 70 JUNE, 1926

# TIMELY INFORMATION ABOUT THE EUROPEAN CORN BORER [1]

L. H. WORTHLEY, Administrator in Corn-Borer Control, and D. J. CAFFREY Entomologist, Corn-Borer Investigations, Bureau of Entomology

The picture on this page shows one of many fields of dent corn ruined by the European corn borer in Essex and Kent Counties, southwestern Ontario, in 1925. Such fields were common over an area of about 400 square miles. Some of these were less than 25 miles distant from cornfields in the United States. The corn borer has been known in the counties mentioned

FIG. 1.—A field of dent corn ruined by the European corn borer. Ontario, Canada, 1925. (Photograph furnished by Entomological Branch, Department of Agriculture, Canada)

[1] The U. S. Department of Agriculture, Bureau of Entomology, and the Federal Horticultural Board cooperating with State departments of agriculture.

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for only three growing seasons. Farming conditions there closely resemble those in the parts of Michigan, Ohio, Pennsylvania, and New York bordering Lake Erie. Unless prompt and heroic measures are taken to control the borer and to retard its further spread in these regions, the total destruction illustrated in Figure 1 may be repeated in our cornfields.

## QUARANTINE ON ACCOUNT OF THE EUROPEAN CORN BORER

Federal and State quarantines designed to prevent the transportation of green corn on the cob to points outside the quarantined areas are strictly enforced during July, August, September, and part of October in Western New York, Pennsylvania, Ohio, and Michigan. The areas at present under quarantine are inclosed by the heavy black line on the map shown on page 3.

Warning notices listing the quarantined areas in detail are posted in public places throughout the areas.

The possible spread of the European corn borer through commerce in infested crops is a serious matter because the insect might be carried long distances in this way. Therefore all vehicles moving to points outside the quarantined area are closely inspected.

In 1925, the automobiles stopped and inspected for this purpose totalled 2,427,020 (1,418,829 in Ohio, 700,263 in Michigan, 258,762 in Pennsylvania, and 49,166 in western New York). From these cars 171,502 ears of corn were seized, and these were found to contain a total of 1,972 European corn borers. In 131 instances corn was taken from automobiles destined for points more than 100 miles distant. These facts illustrate the necessity for thoroughgoing inspection to prevent new infestations of the European corn borer from breaking out at points far distant from the present quarantined areas.

All roads leading out of the quarantined areas are guarded by uniformed inspectors. Signs informing travelers of this fact are placed on the roads and roadsides.

Stop! Do not refuse to stop at quarantine lines. Such refusal is considered a violation in itself.

*Roadside stands.*—When selling roasting ears at roadside stands vendors are requested to inform patrons regarding the quarantine. No restriction is placed on transporting corn from one point to another within the quarantined areas.

The cooperation of all concerned is earnestly solicited in enforcing the corn-borer quarantine.

## SCOUTING

Scouting to determine additions to the infested area begins in early July. Scouting crews are sent to townships adjoining the known infested areas. These crews average from two to four men, depending on the character of the area to be scouted. Foremen of scout crews are instructed to inform owners or tenants before entering their property. Each township is scouted for one week unless infestations of the European corn borer are found. When worms or other insect stages that might be those of the corn borer are found they are immediately sent to the laboratory to be identified. Scouts can not definitely say that corn-borer infestation has been found until information is received from the laboratory. Scouting crews are instructed to act in a gentlemanly manner at all times and any misconduct on their part should be reported immediately to the Cleveland office, 2036 East Twenty-second Street. As they proceed, scouting crews post small triangular "stickers" or arrows on poles, fences, and corners, for the information and guidance of general foremen. These stickers are marked with the date, time of day, and foreman's initials. The direction in which the crew is working is indicated by the way the small end of the sticker is pointing.

Newly infested towns are listed in the quarantine about November 1 each year.

## FIELD SURVEY

A survey of European corn-borer conditions within the infested area will begin about August 15 to determine the amount or severity of infestation throughout the area.

This work is done in alternate townships within the infested area by making counts in five separate fields per township.

Men engaged in this work are provided with United States Bureau of Entomology badges and will explain to property owners or occupants the reason for entering their fields. The object of this work is to learn where the most severe infestations occur and the general increase or decrease from year to year. The effect of control practices as described by State regulations is also determined. This work

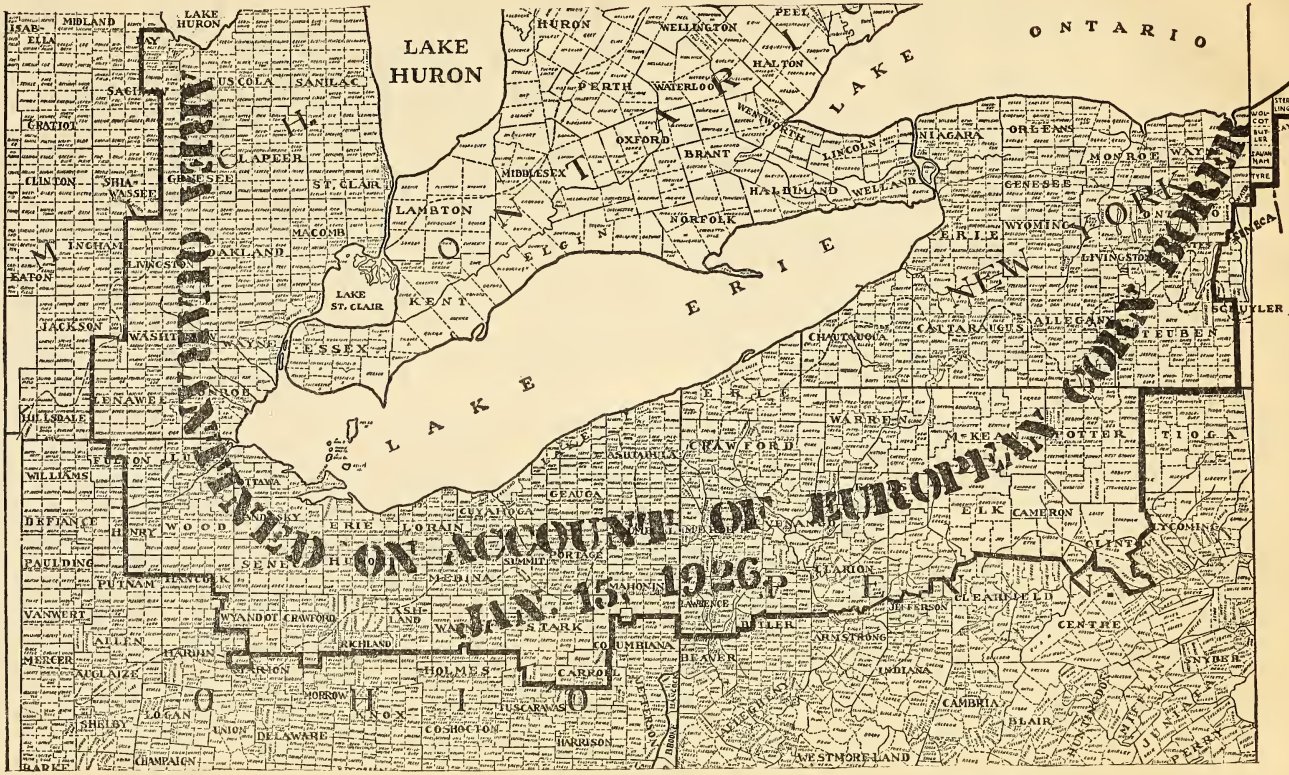


FIG. 2.—Area under quarantine against the European corn borer in the lake region. The heavy black line is the border of the quarantined area. All of the Ontario section shown on the map is infested with the corn borer

as conducted in 1925 resulted as follows:

*Summary of European corn borer field counts in Ohio, New York, Pennsylvania, and Michigan in 1925*

| | |
|---|---|
| Number of townships | 302 |
| Number of fields examined | 1,496 |
| Total acreage examined | 8,452.5 |
| Total stalks in examined area | 100,763,263 |
| Total stalks examined | 752,900 |
| Estimated number of infested stalks in examined area | 1,364,534 |
| Estimated number of larvæ in examined area | 2,125,609 |
| Average per cent of stalks infested | 1.35 |
| Average larvæ per infested stalk | 1.56 |
| Total larvæ per 100 stalks | 2.11 |

## HELP REDUCE EUROPEAN CORN-BORER POPULATION ON YOUR FARM

Cut all corn close to the ground and as early in the season as possible. In case of small fields, use a short-handled hoe for this purpose.

Low cutting attachments for use on many of the ordinary corn harvesters can now be purchased from local farm machinery dealers at reasonable cost. These attachments should be obtained and used for this season's harvest so as to destroy practically all the European corn borers in the fields. Many of the new corn binders to be placed on the market this year will have low cutting attachments.

*High stubble shelters many borers.*—Cutting cornstalks by hand or with machines in a manner which leaves stubble from 12 to 24 inches in height allows numbers of borers to remain in the fields, thus serving to increase the infestation the following year. If, for example, only 1 stubble in 100 is infested with 1 borer each, this averages 100 borers per acre. Ten out of each hundred borers are killed by winter conditions, leaving 90 borers per acre. About one-half of the remaining borers (or 45) develop into female moths and each of these females lays about 350 eggs. Thus 45 female moths will lay a total of 15,750 eggs on the corn plants. This shows the importance of cutting stalks low, even where the infestation is only slight.

In the fall of 1925, in some areas in the Lake Erie region, borers were present in the stubble in dangerous numbers, and commercial damage was closely approached. Infestation found in stubble after an examination of 29 fields containing 177 acres, 10 of the fields having been machine cut and 19 fields having been hand cut, was as follows:

*Average height of stubble, 13.5 inches*

| | |
|---|---|
| Estimated stubble in the 29 fields | 1,746,977 |
| Estimated infested stubble | 128,996 |
| Estimated larvæ in stubble | 143,839 |
| Average per cent of stubble infested | 7.38 |
| Average larvæ per infested stubble | 1.1 |
| Total larvæ per 100 stubble | 8.1 |

The following table illustrates strikingly the benefit derived from early and low cutting:

*Typical records of stubble infestation showing percentage of borers remaining in stubble*

| | Per cent |
|---|---|
| Cornstalks cut September 16: | |
| 24-inch stubble contained | 30.7 |
| 12-inch stubble contained | 16.6 |
| 6-inch stubble contained | 7.3 |
| Cornstalks cut October 9: | |
| 24-inch stubble contained | 45.1 |
| 12-inch stubble contained | 23.7 |
| 6-inch stubble contained | 8.7 |
| Cornstalks cut November 3: | |
| 24-inch stubble contained | 74.5 |
| 12-inch stubble contained | 41.8 |
| 6-inch stubble contained | 22.7 |

These figures show plainly that 12-inch stubble of corn cut in the middle of September left about 16 per cent of the total number of borers originally present in the field. From corn cut at the same height during the first week of November, nearly three times as many, or about 41 per cent of borers, remained in the stubble.

*Hungarian farmers suppress the corn borer.*—Extensive observations made by a representative of this department in Europe, particularly in Hungary during 1925, showed that in communities where the corn was cut close to the ground and the stalks regularly burned, fed, or otherwise disposed of, the infestation and damage by the European corn borer were very slight. In communities where the corn was cut in such a manner as to leave high stubble and where general farm clean-up was not practiced, infestation and damage were very heavy.

*Cultivation after plowing stalks or stubble.*—In cultivating fields where cornstalks or corn stubble have been plowed under during the previous fall or this spring, it is important to remember that this material should not be dragged to the surface. Where this is done many of the borers find favorable refuge in the dragged-up portions and thus escape destruction.

A disk harrow should be used in cultivating these fields, if possible, instead of a toothed harrow. A disk drill should be used in sowing.

*Silos.*—Place the corn in silo early, taking precautions to cut low. Borers contained in silage are killed either by mechanical injury or through conditions existing within the silo.

*Sweet corn disposal.*—Feed or destroy stalks of early sweet corn. This is important because when the stalks dry out, the borers migrate to near-by weeds and can not be destroyed by the regular harvesting methods. There are now available portable silage machines, equipped with attachments for low cutting, which cut the stalks close to the ground and in the same operation reduce the fodder to finely cut corn, thus destroying the borers contained therein. Such fodder can be placed in the silo or returned directly to the ground.

*Warning: Disposal of trap crops.*—Early sweet corn planted as a trap crop should be fed or destroyed not later than August 15 by the methods previously described.

Regulations in Pennsylvania, Ohio, and Michigan require low cutting of cornstalks and general destruction of corn refuse.

All agencies engaged in clean-up work are intensely interested in helping the corn growers of this country to combat this pest. They are trying to develop methods that will cause the least possible additional cost in handling the corn crop and which at the same time will keep the corn borer from doing commercial damage. Remember that should this pest cause a 10 per cent crop loss, this condition will very materially affect the growing of corn. Such a loss may occur in the very near future in some localities in case thorough clean-up measures are not adopted. It becomes a matter of great personal interest to every farmer within and surrounding the areas now infested to endeavor to conform with the regulations promulgated by his State.

## HABITS OF THE BORER

The principal methods for controlling the European corn borer are based upon the fact that the pest spends the late fall, winter, and spring (until June) as a fully grown worm or borer, in any part of the corn plant large enough to serve as a hiding place. This means any part of the stalk, leaves, stubble (except the very small hairy roots), cobs, and husks. Under conditions of bad infestation a small number of the borers may also pass the winter in large-stemmed weeds or grasses growing among, or close to, the corn.

*The weak link in the life of the corn borer.*—It is during the overwintering period that the borer shows the weakest link in its existence and it then may be destroyed easily by burning, feeding to livestock, or other methods previously described. If left until later than June 1, the borers change first into reddish-brown, shuttle-shaped pupæ (the resting stage), and then into moths which fly to the new crop of corn and lay their eggs to produce another brood of borers. The method of combat, therefore, consists in killing the borers in their hiding places before June and, to be safe, preferably before May 15.

After about two weeks in the resting stage the parent moths appear during a period extending from about June 15 to early August.

*There is no successful way of fighting corn-borer moths.*—The habits of the moths have been carefully studied. They fly during the evening or early morning and therefore are seen only rarely. In daylight they remain concealed underneath the leaves of various plants or in thick growths of weeds and grasses. In the moth stage the European corn borer can not be successfully destroyed. Various trap lights and poisoned baits have been thoroughly tested and found to be useless under ordinary conditions.

*The moths fly strongly.*—It has been determined that the moths can fly for a distance of at least 20 miles. During windy periods the direction of flights is with the wind. Large bodies of water do not check their flight as the moths have been seen to alight on the surface of the water and again take flight.

*Community clean-up.*—This ability of the moths to fly long distances makes it necessary that clean-up operations be efficiently conducted on a community-wide scale. The moths emerging from a single poorly cleaned, infested field are sufficient again to infest near-by fields even where precautions have been taken to dispose of all infested material in these fields.

*Where to find the eggs.*—Beginning about the middle or the last of June and until early August, depending upon

the character of the season, the eggs of the European corn borer may be found on the under surfaces of the corn leaves. Sometimes they are placed on the upper surface of the leaf. The egg masses are irregularly shaped and usually about one-eighth of an inch wide. Each mass contains

FIG. 3.—Broken corn tassel. A common sign that the European corn borer is present

from 15 to 20 eggs, overlapped like fish-scales. They are white when first laid, later turning pale yellow and becoming darker with a black area just before the borer hatches. By closely examining the under surface of corn leaves it should be possible for any person to find these egg masses in fields where the moths are numerous. In the egg stage, the control of the corn borer has not proved practicable, because the eggs are laid over a long period of time and therefore several applications of insecticides are necessary to obtain even partial destruction of them.

The eggs hatch in from four to nine days, depending upon weather conditions.

*The work of the young borer.*—The young borer immediately after hatching is about one-sixteenth of an inch long. Usually it feeds for a short time upon the surface of the leaf, near its place of hatching, or upon tender leaves and tassels in the growing "bud" of the corn. As the borer grows it bores into the tassel and stalk at any convenient point, often entering the stalk at or near where the leaves join it. From June 15 to about July 15 the work of the borer in the plant may remain unnoticed, but a close examination will reveal small holes made by it in entering the stalk and small masses of sawdustlike castings which it has thrown out.

*Broken tassels.*—Beginning about July 15, particularly on early corn, many tassels on infested plants break over because the borer has hollowed out the tassel stem. These broken-over tassels (fig. 3), with masses of castings near the breaks, are at that time the plainest sign that the European corn borer is present. By cutting open such broken tassel stems the offending borer often may be found, in its burrow, a few inches below or above the break. Not all corn plants infested by the borer have the tassel stem broken over. In such cases the borer may be found in other parts of the plant.

*Ravages of full-grown borer.*—After August 15, during an ordinary season,

FIG. 4.—Portion of corn plant showing external evidence of the work of the European corn borer

the damage inflicted by the borers is very noticeable. At this period many of them have become nearly full grown. In this case the injury to the interior of the plant may be readily detected by the presence of small holes in the stalk and large masses of white or bright yellow castings, which

have been thrown out by the borer, clinging to the plant (fig. 4). Upon cutting open the stalk near these holes the borer usually may be found within its burrow, although in some instances it deserts one plant and enters another near by. In late summer and fall many of the infested plants break over at the point of greatest injury to the stalk, especially when subjected to strains by high winds or heavy rains.

During the worm or borer stage the European corn borer is so well protected by hiding within the plant that it is not practicable to destroy it by the use of any known ins cticide.

*Borers enter the ears.*—As soon as the corn forms ears these may be entered by the borers at practically any point—through the husk, through the silks, or through the ear stem or "shank." Once inside the ear the borers feed upon all parts of the grain, silks, and cob, often burro ing down through the center of the cob, or diagonally through it.

Usually it is possible to detect infested ears by the same signs as have been described for the stalks. Sometimes, however, the entrance hole made by the borer in entering the ear is so small, or so well concealed, that the question of infestation can be determined only by stripping off the husk and breaking or splitting open the cob.

*Transportation of ears spreads borers.*—Naturally the transportation of the infested ear corn from infested to uninfested territory is sure to spread the European corn borer. For this reason strict quarantines are maintained by the State and Federal Governments to prevent the transportation of such material.

*Ear corn in cribs.*—Infested ear corn of the previous year's crop, when allowed to remain in cribs through June, July, and early August, acts as a source of new infestation for the reason that the borers within the cobs change to moths which emerge and lay their eggs on the new crop.

*Winter stage.*—In the region of the Great Lakes most of the borers reach full growth about August 15. At this time they are nearly an inch long and about one-eighth of an inch thick. They continue feeding, or simply boring in the plants, until cold weather halts their activities. The winter is passed as a fully grown worm or borer, as previously described.

## OTHER CATERPILLARS OFTEN MISTAKEN FOR EUROPEAN CORN BORER

Several kinds of common, native caterpillars, "worms," or borers are often mistaken for the European corn borer, thus causing needless alarm. Some of these are similar in appearance to the European corn borer, but others, although very different in appearance, cause damage that often resembles it.

It is important that all corn growers be on the lookout for the European corn borer. Therefore, when any specimens of worms, caterpillars, or borers suspected of being the European corn borer are found, they should be placed in a tight tin or glass container, together with a few strips of crumpled paper and sent to the nearest corn borer laboratory. Such laboratories are located at 17 Division Street, Silver Creek, N. Y.; at Sandusky, Ohio (address P. O. box 283), and at Monroe, Mich.

READ THE SUMMARY ON PAGE 8

## SUMMARY

Please give your best cooperation and support to the quarantines.

Market within the boundaries indicated by the quarantine map roasting ears grown inside quarantine areas.

Obtain and use a low-cutting attachment for your corn binder, if possible.

High stubble is a neighborhood menace.

Farmers in Hungary, a European home of the corn borer, have shown the benefit to be obtained through good clean-up work.

Toothed harrows dig up the enemy corn borers, which thus escape destruction. Therefore use disk harrows instead.

Use silos to their full capacity.

Important. Make an effort to destroy early sweet corn or to place it in the silo, including the corn used as a trap crop.

Comply with State regulations in clean-up work.

Control work against the European corn borer is most effective during the late fall, winter, and spring months.

Clean-up work by the entire community is necessary because the moths emerging from a poorly cleaned or uncleaned field will again infest cornfields for considerable distances.

Broken-over tassels are a good indication of European corn borer infestation.

Ear corn grown within quarantine areas can not be taken or shipped outside such areas because it may spread borers to localities not yet infested.

The European corn borer may be present in the fields without your knowledge. See description herein. Mail suspicious specimens as per directions.

If possible, visit cornfields in Essex and Kent Counties, Ontario, during late August and observe the ravages of the European corn borer.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1926